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U. S. Department of Transportation
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Subject: FulcrumAir Corp. Petition for Exemption Pursuant to 49 U.S.C. 44807 and 14 C.F.R. Part 11 to Authorize Commercial Rotorcraft External-Load Operations with the E7500 UAS

To Whom it May Concern:

Pursuant to 49 U.S.C. 44807 and 14 C.F.R. Part 11, FulcrumAir Corp. (FulcrumAir), by and through undersigned counsel, hereby applies for a Grant of Exemption from the Federal Aviation Regulations (FARs) identified below to allow FulcrumAir to operate its proprietary E7500 UAS, which is an electric vertical takeoff and landing (eVTOL) heavy lift coaxial helicopter designed to sling a machine used to install Bird Flight Diverters (BFDs) and other machines on overhead power transmission lines. The E7500 UAS has a maximum takeoff weight of 220 pounds. FulcrumAir currently conducts the proposed operations in this petition for exemption with the E7500 UAS in Canada under a Special Flight Operating Certificate (SFOC) issued by Transport Canada.

The E7500 UAS relies upon the lift generated by two coaxial, counter-rotating main rotors to support flight and therefore the E7500 UAS meets the definition of a "rotorcraft" in 14 C.F.R. §1.1.[1] The machine slung by the E7500 to install BFDs is an external payload and therefore the proposed operations are rotorcraft external-load operations. For this reason, FulcrumAir intends to apply for a Part 133 Rotorcraft External-Load Operator Certificate. This Petition for Exemption seeks the relief necessary for FulcrumAir to conduct Part 133 external-load rotorcraft operations with the E7500.

In support of this Petition for Exemption, FulcrumAir will submit the following associated UAS operating documents:

- FulcrumAir E7500 Series Instructions for Continued Airworthiness (ICA)
- FulcrumAir E7500 Series Unmanned Aircraft Maintenance Manual (UMM)

[1] 14 C.F.R. § 1.1 defines "rotorcraft" as "a heavier-than-air aircraft that depends principally for its support in flight on the lift generated by one or more rotors."

- FulcrumAir E7500 Series Unmanned Aircraft Flight Manual (UFM)
- FulcrumAir UAS Company Operations Manual
- JARUS SORA Risk Assessment
- JARUS SORA Concept of Operations
- National Environmental Policy Act (NEPA) Compliance Document[2]

These documents will be submitted on a confidential basis under separate cover pursuant to 14 C.F.R. §11.35(b), as the documents contain confidential commercial and proprietary information of FulcrumAir. The information contained in this material is not generally available to the public and is protected from release under the Freedom of Information Act, 5 U.S.C. § 552 *et seq*.

I. BACKGROUND AND DESCRIPTION OF PROPOSED UAS OPERATIONS

FulcrumAir is a company founded and based in Calgary, Alberta, Canada and Wellington Colorado USA that designs, manufactures and operates UAS, one of which is the E7500 eVTOL heavy lift UAS. The primary function of the FulcrumAir E7500 is to transport cargo via a cargo hook and sling payloads short to medium distances at low altitudes. Specifically, the FulcrumAir E7500 slings an independently powered machine on a tether that is designed to install BFD on overhead power transmission lines (LineFly); install other cable sensing machines in the overhead power transmission line environment; or sling other static loads as required by FulcrumAir. These operations have been ongoing in Canada for the past three years under the authority of an SFOC. FulcrumAir seeks to conduct the same operations in the U.S. after obtaining a Part 133 Rotorcraft External-Load Operator Certificate and the relief requested in this petition for exemption. FulcrumAir's prior experience conducting these operations in Canada helps support a finding that the same operations can be conducted safety in the U.S.

FulcrumAir is currently pursuing type certification of the E7500 UAS as a special class of aircraft under 14 C.F.R. § 21.17(b) using the durability and reliability (D&R) process. The proposed operations will also help support FulcrumAir's certification efforts for the E7500 UAS.

A. E7500 UAS Description

The Fulcrum E7500 UAS has a configuration similar to that of a coaxial helicopter. Like a conventional coaxial helicopter, both lift and yaw authority are provided by two coaxial, counter-rotating main rotors. Unlike a conventional design, there is no cyclic pitch control. Rather, pitch and roll control are affected by four control motors positioned at the upper extremity of the aircraft. This allows pitch and roll control authority to remain the same regardless of aircraft gross weight. Each main rotor is driven by an electric motor via a synchronous belt drive transmission system. A lightweight frame supports the motors, transmission, and landing gear. This configuration transmits thrust loads from the main driveshaft bearings to the cargo hook. All payloads are slung from the cargo hook, which includes a quick release mechanism. Lithium Polymer batteries

[2] This document provides responses to the FAA's standard NEPA-related RFI questions.

supply electrical power to the electrical loads aboard the aircraft. Four 25.9V, 46000mah LiPo battery packs are connected in a 2 series, 2 parallel configuration to create a 51.8V nominal power system. Internal avionics sensors of the automated flight controller include accelerometers, gyroscopes and barometers. Redundant sensors include GPS, magnetometers, accelerometers, gyroscopes and barometers. The E7500 has a maximum takeoff weight of 220 lbs, an empty weight of 93 lbs, with a maximum payload capacity of up to 127 lbs. Additional details regarding the design and operating capabilities of the E7500 UAS are located in the SORA ConOps, pages 8-36 and the E7500 UAS Flight Manual (UFM) submitted under separate cover.

B. Mission Description

The main purpose of the proposed operations is to sling robots from the takeoff location to the powerline span or structure being worked on, the UAS then returns to the takeoff location once the mission is completed. The robot is designed as a stand-alone unit, it rests on the line without the need to be attached to the E7500. For efficiency purposes, the E7500 remains attached by a retract-a reel and follows the robot until it completes its tasks.

FulcrumAir pilots plan missions using all available aviation charts handbooks and websites. The mission is planned in detail using a site survey document and satellite imagery software, which is reviewed by the crew prior to the operation taking place. The crew drives to the operations site and conducts multiple takeoffs and landings from a single location that is located within 1.08 nm (2 km) of the ground control station (GCS) where the pilot is located.

In addition to the above, the following general operating limitations will apply to the proposed operations:

- All operations are limited to overhead power transmission line environment and all flights take place along the power transmission line right of way;
- Transmission lines are all located in rural and sparsely populated environments;
- All flights occur within visual line of sight (VLOS) of the pilot, visual observer and payload operator (when used);
- Operations are limited to Class G airspace;
- Flights occur at the lowest altitude possible necessary to safely clear ground obstacles (typically 150 feet AGL), but never higher than 400’ AGL;
- Daylight operations only in VMC; and
- Take-off and landing locations are coordinated with the utility provider and land-owner permission will be acquired prior to the operation when necessary.

Additional details regarding the limitations applicable to the proposed operations are located in The Company Operations Manual (COM), Specific Operating Procedures (SpOP) section.

* * * *

In accordance with 14 C.F.R. §11.81(a), the contact information for Petitioner is as follows:

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II. REGULATIONS FROM WHICH EXEMPTION IS SOUGHT

FulcrumAir seeks an exemption from the following interrelated provisions of 14 C.F.R. Parts 61, 91 and 133:

FAR	Description
§ 61.3(a)(1)(i)	**Requirement for certificates, ratings, and authorizations.**
§ 91.7(a)	**Civil aircraft airworthiness.**
§ 91.109(a)	**Flight instruction.**
§ 91.151(b)	**Fuel requirements for flight in VFR conditions.**
§ 91.403(b)	**General.**
§ 91.405(a)	**Maintenance required.**
§ 91.407(a)(1)	**Operation after maintenance, preventive maintenance, rebuilding, and inspections.**
§ 91.409(a)(1) and (2)	**Inspections.**
§ 91.417(a) and (b)	**Maintenance records.**
§ 133.19(a)	**Rotorcraft.**
§ 133.21(a) and (b)	**Personnel**
§ 133.27(b)	**Availability, transfer, and surrender of certificate.**
§ 133.33(a) and (b)(1)	**Operating Rules.**
§ 133.43	**Structures and design.**
§ 133.45(a)-(d)	**Operating limitations.**

§ 133.47	**Rotorcraft-load combination flight manual.**
§ 133.49	**Markings and placards.**
§ 133.51	**Airworthiness certification.**

Listed below are the specific Federal Aviation Regulations (FARs) sections from which an exemption is sought, the rationale for why an exemption is needed, and a brief summary of the operating procedures and safeguards. As described below and more fully in the supporting operational documents submitted under separate cover, the operating procedures and safeguards adopted by FulcrumAir, as well as the experience gained conducting the same transmission line work in Canada, support a finding that the proposed operations can be conducted at a level of safety that is at least equal to that provided by the rule from which exemption is sought.

A. Part 61 Exemption Requested

FulcrumAir seeks relief from the following Part 61 provision.

§ 61.3(a)(1)(i), Requirement for certificates, ratings, and authorizations

Section 61.3(a)(1)(i) states:

> §61.3(a)(1)(i), Requirement for certificates, ratings, and authorizations
>
> (a) Required pilot certificate for operating a civil aircraft of the United States. No person may serve as a required pilot flight crewmember of a civil aircraft of the United States, unless that person:
> (1) Has in the person's physical possession or readily accessible in the aircraft when exercising the privileges of that pilot certificate or authorization—
> (i) A pilot certificate issued under this part and in accordance with §61.19;

FulcrumAir seeks relief from §61.3(a)(1)(i) to the extent necessary to permit persons holding a Remote Pilot Certificate with small UAS rating to act as the remote pilot in command (RPIC) in the context of a commercial Part 133 rotorcraft external-load UAS operation. FulcrumAir has developed a comprehensive training program for its pilots that will ensure that a pilot holding a Remote Pilot Certificate with small UAS rating can conduct the proposed operations at an equivalent level of safety to an operation using a pilot that holds a certificate issued under Part 61.

Under the training program, a pilot candidate starts with a base knowledge of aviation ground school provided by Part 107 training and testing, which is then expended on extensively to include extensive flighting planning and survey training that is specific to FulcrumAir's ConOps. The training program is modeled off crewed aviation "on type" training. The "on type" training utilizes a tiered approach where the pilot training is structured in such a way that the lowest risk operations

are trained prior to higher risk operations. For example, a pilot candidate will receive training on part 107 operations using small UAS, prior to being considered for Part 133 operations. Additional training includes things like human factors training, first aid, root cause analysis etc. All FulcrumAir pilots participating in the proposed operations are required to complete this "on type" ground training, practical flight training applicable to the E7500 UAS. Pilot candidates will be required to demonstrate proficiency during a flight test and receive a positive recommendation from the Chief Pilot or operations manager to gain certification "on type." The whole training process to go from no experience to trained and qualified pilot takes approximately four months to complete.

FulcrumAir's Chief Pilot will also be required to comply with the knowledge and skill requirements of §133.23 which will ensure that the Chief Pilot is qualified to assess the knowledge and flight proficiency of pilot candidates completing "on type" training. Additional details regarding FulcrumAir's "on type" training program are located pages 21-29 and 60 of the COM.

For the reasons discussed above, an equivalent level of safety can be maintained using a RPIC that holds a Part 107 Remote Pilot Certificate, and an exemption from certificate requirements in §61.3(a)(1)(i) is therefore appropriate.

B. Part 91 Exemptions Requested

FulcrumAir seeks relief from the following provisions of Part 91.

§ 91.7(a) Civil aircraft airworthiness

Section 91.7(a) states:

> §91.7(a), Civil aircraft airworthiness
> (a) No person may operate a civil aircraft unless it is in an airworthy condition.

Inasmuch as there will be no airworthiness certificate issued for the E7500 UAS, FulcrumAir seeks an exemption from § 91.7(a) *Civil aircraft airworthiness*. While the UAS operated by FulcrumAir will not have an airworthiness certificate, the RPIC will be able to determine that the UA is in an airworthy condition prior to flight. As described more fully in the operating documents, this is achieved through FulcrumAir's mission planning procedures, including the use of detailed preflight checklists used to confirm and document that the UAS is in an airworthy condition. Preflight checklists are included in the E7500 UFM submitted under separate cover. The UFM was prepared to support type certification of the E7500 UAS and the manual is currently under review by the FAA. The UFM was developed using crewed aviation principles and is a mature document that is used daily by FulcrumAir pilots operating the E7500 UAS in Canada. In addition to the UFM, the compliance with the maintenance and inspection procedures documented in the E7500 UMM and ICA will also ensure that the RPIC will be able to determine that the UA is in an airworthy

condition prior to flight. The UMM and ICA were also prepared to support type certification of the E7500 UAS and the documents are currently under review by the FAA in the certification context.

§ 91.109(a) Flight instruction

Section 91.109(a) states:

> §91.109 Flight instruction; Simulated instrument flight and certain flight tests.
> (a) No person may operate a civil aircraft (except a manned free balloon) that is being used for flight instruction unless that aircraft has fully functioning dual controls. However, instrument flight instruction may be given in an airplane that is equipped with a single, functioning throwover control wheel that controls the elevator and ailerons, in place of fixed, dual controls, when -
>
> (1) The instructor has determined that the flight can be conducted safely; and
>
> (2) The person manipulating the controls has at least a private pilot certificate with appropriate category and class ratings.

Section 91.109(a) requires aircraft used for "flight instruction" to have "fully functioning dual controls." FulcrumAir has an extensive training program, which includes flight instruction, modeled after crewed aviation. The E7500 is operated using handhold transmitters in combination with the Ground control station laptop for operations. The aircraft does not have fully functioning dual controls and therefore an exemption from § 91.109(a) is necessary. As discussed below, FulcrumAir's training procedures will ensure that flight instruction can occur safely using an aircraft that is not equipped with fully functioning dual controls.

As detailed in the "Training and competency" section of the COM (pages 21-29), FulcrumAir has established a UAS training program to ensure that all UAS flight crew members acquire and maintain the competencies to perform their assigned duties in terms of knowledge, skills, and attitude. The training program consist of ground school training and practical flight training. All flight training activities occur during dedicated training sessions a safe and controlled environment. Geo Fencing is used to maintain containment of the operation. Besides procedural and normal operations training, there is a particular focus on emergencies, both practical and theoretical emergencies are performed. The trainer and trainee will be co-located together during training operations. During training operations, if necessary to ensure safety, control of the UAS will be demanded by the trainer and the trainee must comply. Handover to alternate control station procedures are addressed in Section 3.11 of the UFM.

§91.151(b), Fuel requirements for flight in VFR conditions

Section 91.151(b) states:

> §91.151(b), Fuel requirements for flight in VFR

> . . .
> (b) No person may begin a flight in a rotorcraft under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 20 minutes.

FulcrumAir seeks an exemption from §91.151(b) *Fuel requirements for flight in VFR conditions,* which would otherwise require a 20-minute fuel reserve to be maintained. Given the short duration[3] of each mission and the fact that the UA is electric powered, it is not practical to maintain a 20-minute fuel reserve. In lieu of a 20-minute fuel reserve, an equivalent level of safety can be maintained by requiring a 15% battery reserve for all operations.

The proposed operating conditions are always VLOS under VMC conditions and operations are limited to rural and sparsely populated environments. Additionally, the UA will not operate beyond a 1.08 nm range from the RPIC. Given these factors, a 15% fuel reserve will be more than adequate to provide sufficient time for the RPIC to designate a suitable alternate landing site if necessary, transit to that point and land, and will therefore provide an equivalent level of safety to the fuel reserve requirement in 91.151(b). As described on pages 21 and 29 of the UFM, the GCS features a visual and audible warning/caution system that displays the voltage remaining to the RPIC (shown below), along with an audible warning:

- Blue – nominal 100 – 35%
- Yellow – caution 35% - 15%
- Red – critical 15%

> **§ 91.403(b) General**
> **§ 91.405(a) *Maintenance required***
> **§ 91.407(a)(1) *Operation after maintenance, preventive maintenance, rebuilding, or alteration***
> **§ 91.409(a)(1) and (2) *Inspections***
> **§ 91.417(a) and (b) *Maintenance records*.**

FulcrumAir seeks an exemption from the following maintenance and inspection-related requirements of Part 91: §§91.403(b) 91.405(a) *Maintenance required*, 91.407(a)(1) *Operation after maintenance, preventive maintenance, rebuilding, or alteration*, 91.409(a)(1) and (2) *Inspections*, and 91.417(a) and (b) *Maintenance records*. These regulations specify maintenance, inspection, and records standards in reference to Part 43. An exemption from these regulations is needed because these sections apply to an aircraft with an airworthiness certificate, which the E7500 UAS will not have, and because compliance with these regulatory provisions in the context of UAS operations is not feasible.

[3] Average flight times are specified on page 29 of the UFM.

FulcrumAir also seeks relief from §91.403(b), which states that no person may perform maintenance, preventive maintenance, or alterations on an aircraft other than as prescribed in Subpart E of Part 91 and other applicable regulations, including Part 43, is also needed as it relates to the issue of *who* may perform maintenance and approve the aircraft for return to service following that maintenance. While Part 43 does not apply to an aircraft without an airworthiness certificate, per the applicability requirements in Part 91, Subpart E found in § 91.401, § 91.403(b) would apply to the E7500 UAS and an exemption is therefore required.[4]

An equivalent level of safety to these maintenance, inspection, and recordkeeping requirements, including requirements relating to personnel that may perform such requirements, will be achieved because these activities will be performed in accordance with the procedures detailed in the E7500 UMM, UFM, ICA and the FulcrumAir UAS Company Operations Manual. As described more fully in these operating documents, the following factors support an equivalent level of safety finding for the above referenced Part 91 maintenance and inspection-related requirements:

- The UMM and ICA were prepared in connection with FulcrumAir's efforts to type certify the E7500 and the material is therefore designed to meet the requirements for inspecting and maintaining the airworthiness of the E7500 UAS. All required maintenance for the UAS is described clearly and easy to comprehend.

- FulcrumAir uses a similar "on type" training process to ensure personnel performing maintenance (Maintainers) are qualified to perform maintenance on the UAS.

- The Manufacturer (FulcrumAir) trains all the Maintainers and is responsible for maintenance other than field maintenance. The training for Maintainers is described in the UMM. Additional details are also located on page 23 of the FulcrumAir UAS Company Operations Manual.

- The UFM details daily inspections required for safe operation of the UAS. These inspections are conducted by a pilot, daily, weekly, and prior to departure to the mission site. The UFM also describes field level and preventative maintenance, as well as testing and inspection criteria following maintenance. *See* UFM pages 65-73.

- Journey logs are used to track the hours flown, maintenance performed and major component logging. The UAS journey logs are modeled off of crewed aviation and the log books are updated after each day to include total time in air.

Adherence to the maintenance, inspection, and recordkeeping requirements contained in the operating documents will allow FulcrumAir to achieve a level of safety equal to or greater than that provided by §§ 91.403(b), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b).

[4] *See e.g.*, Exemption No 18596 issued to Overwatch Aero, LLC at 14 (Docket No. FAA-2018-0857).

C. Part 133 Exemptions Requested

FulcrumAir seeks relief from the following Part 133 provisions.

§133.19(a) Rotorcraft
§133.51 Airworthiness certification.

Section 133.19(a) states:

> §133.19 Rotorcraft
> (a) The applicant must have the exclusive use of at least one rotorcraft that -
> (1) Was type certificated under, and meets the requirements of, part 27 or 29 of this chapter (but not necessarily with external-load-carrying attaching means installed) or of § 21.25 of this chapter for the special purpose of rotorcraft external-load operations;
> (2) Complies with the certification provisions in subpart D of this part that apply to the rotorcraft-load combinations for which authorization is requested; and
> (3) Has a valid standard or restricted category airworthiness certificate.

Section 133.51 states:

> §133.51 Airworthiness certification.
> A Rotorcraft External-Load Operator Certificate is a current and valid airworthiness certificate for each rotorcraft type certificated under part 27 or 29 of this chapter (or their predecessor parts) and listed by registration number on a list attached to the certificate, when the rotorcraft is being used in operations conducted under this part.

Relief from §§133.19(a) and 133.51 is necessary because the E7500 UAS is not currently type certified and does not have an airworthiness certificate. An equivalent level of safety to §§ 133.19(a) and 133.5 will be achieved for the same reasons discussed for the requested relief from §91.7(a) *Civil aircraft airworthiness*. The following factors also support a finding that FulcrumAir will be able to safely conduct the proposed Part 133 operations using the E7500 UAS:

- FulcrumAir is currently in the process of type certifying the E7500 UAS using the D&R methodology.

- Transport Canada[5] has approved FulcrumAir to conduct commercial operations in Canada with the E7500 UAS. The operations authorized in Canada are the same as the proposed operations in this petition for exemption and the proposed operating limitations are consistent with the conditions of the SFOC issued by Transport Canada.

[5] Canada is an ICAO Contracting State.

- FulcrumAir has operated the E7500 UAS safely and effectively in Canada for over 3 years, conducting over 200 flights and a cumulative 300 flight hours (200 R&D and 100 Commercial).

- This E7500 UAS has completed failure mode effects and criticality analysis (FMECA) and has a manufacturer's declaration describing the operations it is approved for.

- The E7500 UAS was designed to sling payloads, and the FARs pertaining to the aircraft from which exemption is sought were considered during the initial design and testing phase. Pages 8-36 of the SORA describes the limitations and the system design, and it also includes the Flow Evaluation Area (FEA) conducted on all the structures subjected to a load. All loads acting on the UA during flight have been considered and the appropriate factors of safety have been applied.

- The Operational Safety Objectives (OSO's) detailed on pages 8-14 of the SORA Risk Assessment describe the level at which FulcrumAir manufactures and operates its UAS. These OSO's describe FulcrumAir's Compliance with a SAIL IV operational risk profile. This includes being a proven and competent operator, manufacturer, and maintainer of the UAS. There are advanced and detailed procedures in place to conduct the operation safely and to satisfy the OSO's. FulcrumAir has been accredited by a third party UxS Consulting and The Foremost UAS Test Range to achieve the required integrity levels.

- This UFM and UMM were prepared in connection with FulcrumAir's efforts to type certify the E7500 and the manuals are therefore designed to comply with the manual requirements for a type certified aircraft. Performance, limitations, checklists, emergency procedures and maintenance procedures in the manuals are clearly defined and easy to follow.

§133.21(a) and (b) Personnel

Section 133.21(a) and (b) states:

> §133.21 Personnel.
> (a) The applicant must hold, or have available the services of at least one person who holds, a current commercial or airline transport pilot certificate, with a rating appropriate for the rotorcraft prescribed in § 133.19, issued by the Administrator.
> (b) The applicant must designate one pilot, who may be the applicant, as chief pilot for rotorcraft external-load operations. The applicant also may designate qualified pilots as assistant chief pilots to perform the functions of the chief pilot when the chief pilot is not readily available. The chief pilot and assistant chief pilots must be acceptable to the Administrator and each must hold a current Commercial or Airline Transport Pilot Certificate, with a rating appropriate for the rotorcraft prescribed in §133.19.

While FulcrumAir's Operations Manager and Chief Pilot holds a Helicopter Commercial Pilot License issued by Transport Canada, neither he nor other FulcrumAir pilots hold the certificate required by §133.21(a) and (b) because the E7500 UAS is not type certified and an appropriate rating therefore does not exist. Nevertheless, the proposed operations can be conducted at an equivalent level of safety without complying with §133.21(a) and (b) for the same reasons previously referenced in support of the request relief from §61.3(a)(1)(i); namely, FulcrumAir's "on type" pilot training program and the fact that FulcrumAir's Chief Pilot will still be required to comply with the knowledge and skill requirements of §133.23.

§ 133.27(b) Availability, transfer, and surrender of certificate

Section 133.27(b) states:

> § 133.27 Availability, transfer, and surrender of certificate.
> . . .
> (b) Each person conducting a rotorcraft external-load operation shall carry a facsimile of the Rotorcraft External-Load Operator Certificate in each rotorcraft used in the operation.

The E7500 is a UAS, which makes it impossible to carry a facsimile of the Rotorcraft External-Load Operator Certificate on the aircraft. An equivalent level of safety to this requirement will be achieved by requiring that a facsimile of the Rotorcraft External-Load Operator Certificate be located at the GCS with the pilot.

§ 133.33(a) and (b)(1) Operating rules

Section 133.33(a) and (b)(1) states:

> §133.33 Operating rules.
> (a) No person may conduct a rotorcraft external-load operation without, or contrary to, the Rotorcraft-Load Combination Flight Manual prescribed in §133.47.
> (b) No person may conduct a rotorcraft external-load operation unless -
> (1) The rotorcraft complies with §133.19; and
> . . .

The E7500 UAS is not type certified and therefore no Rotorcraft-Load Combination Flight Manual exists. For this same reason, it is also impossible to comply with subsection (b)(1), which incorporates by reference the requirements of §133.19. An equivalent level of safety to the requirements of §133.33(a) and (b)(1) will be achieved for the same reasons discussed above in support of the requested exemptions from §§133.19(a) and 91.7(a).

§ 133.43 Structures and design

Section 133.43 states:

> §133.43 Structures and design.
> (a) External-load attaching means. Each external-load attaching means must have been approved under -
> (1) Part 8 of the Civil Air Regulations on or before January 17, 1964;
> (2) Part 133, before February 1, 1977;
> (3) Part 27 or 29 of this chapter, as applicable, irrespective of the date of approval; or
> (4) Section 21.25 of this chapter.
> (b) Quick release devices. Each quick release device must have been approved under -
> (1) Part 27 or 29 of this chapter, as applicable;
> (2) Part 133, before February 1, 1977; or
> (3) Section 21.25 of this chapter, except the device must comply with §§27.865(b) and 29.865(b), as applicable, of this chapter.
> (c) Weight and center of gravity -
> (1) Weight. The total weight of the rotorcraft-load combination must not exceed the total weight approved for the rotorcraft during its type certification.
> (2) Center of gravity. The location of the center of gravity must, for all loading conditions, be within the range established for the rotorcraft during its type certification. For Class C rotorcraft-load combinations, the magnitude and direction of the loading force must be established at those values for which the effective location of the center of gravity remains within its established range.

FulcrumAir is unable to comply with the requirements of §133.43 because the E7500 UAS is not currently a type certified aircraft. While the E7500 UAS is not certified, FulcrumAir is currently working with the FAA to type certify the aircraft as a special class of aircraft under §21.17(b). The E7500 was designed to sling payloads and the SORA ConOps (pages 8-36) describes the limitations and the system design. It also includes FEA that has been conducted on all the structures subjected to a load, and all loads acting on the UA during flight have been considered and the appropriate factors of safety have been applied.

The E7500 UAS' external load attaching means were designed and engineered to be fail safe and function in such a way to prevent swinging payloads from affecting the control system. The external load attaching means consists of rated equipment with the appropriate overhead loads factor of safety. In line swivels are used to ensure that spinning payloads do not affect the yaw capability of the aircraft. The payload attaching means are described in the UFM. The UFM includes preflight inspections and pre-rigging inspection checklists (UFM pages 1-31). The procedures and checklists have been developed and refined over years of ongoing commercial operations with the E7500 UAS in Canada.

The design and capabilities of the E7500 UAS, along with compliance with the relevant operating documents, will ensure and equivalent level of safety to the requirements of §133.43.

§133.45(a)-(d) Operating limitations

Section 133.45(a)-(d) states:

> §133.45 Operating limitations.
> In addition to the operating limitations set forth in the approved Rotorcraft Flight Manual, and to any other limitations the Administrator may prescribe, the operator shall establish at least the following limitations and set them forth in the Rotorcraft-Load Combination Flight Manual for rotorcraft-load combination operations:
> (a) The rotorcraft-load combination may be operated only within the weight and center of gravity limitations established in accordance with §133.43(c).
> (b) The rotorcraft-load combination may not be operated with an external load weight exceeding that used in showing compliance with §§133.41 and 133.43.
> (c) The rotorcraft-load combination may not be operated at airspeeds greater than those established in accordance with §133.41 (b), (c), and (d).
> (d) No person may conduct an external-load operation under this part with a rotorcraft type certificated in the restricted category under §21.25 of this chapter over a densely populated area, in a congested airway, or near a busy airport where passenger transport operations are conducted.

The E7500 UAS is not type certified and therefore there is no Rotorcraft-Load Combination Flight Manual for the aircraft. Because there is no Rotorcraft-Load Combination Flight Manual, FulcrumAir is unable to comply with the requirements set forth in §133.45(a)-(d). An equivalent level of safety to the operating limitations in §133.45(a)-(d) will be achieved for the same reasons described in support of the requested exemptions from §§133.19(a) and 91.7(a). The following factors also support a finding that the proposed operations can be conducted safely without complying with the requirements of §133.45(a)-(d):

- This UFM describes the center of gravity limitations in circumstances where the payload and UA are below the E7500's MTOW and where the payload is attached to the designated payload attachment point. All payloads are reviewed by FulcrumAir engineers to ensure attachment of the payload is within the aircraft's center of gravity limitations. For additional details, see UFM pages 1-31.

- The proposed operations will never occur over densely populated areas, in congested airways or near a busy airport. Additional details regarding specific operating procedures are located in the FulcrumAir UAS Company Operations Manual, pages 59-73.

§133.47 Rotorcraft-load combination flight manual

Section 133.47 states:

> §133.47 Rotorcraft-load combination flight manual.
> The applicant must prepare a Rotorcraft-Load Combination Flight Manual and submit it for approval by the Administrator. The manual must be prepared in accordance with the rotorcraft flight manual provisions of subpart G of part 27 or 29 of this chapter, whichever is applicable. The limiting height-speed envelope data need not be listed as operating limitations. The manual must set forth -

> (a) Operating limitations, procedures (normal and emergency), performance, and other information established under this subpart;
> (b) The class of rotorcraft-load combinations for which the airworthiness of the rotorcraft has been demonstrated in accordance with §§133.41 and 133.43; and
> (c) In the information section of the Rotorcraft-Load Combination Flight Manual -
> (1) Information on any peculiarities discovered when operating particular rotorcraft-load combinations;
> (2) Precautionary advice regarding static electricity discharges for Class B, Class C, and Class D rotorcraft-load combinations; and
> (3) Any other information essential for safe operation with external loads.

The E7500 UAS is not type certified and therefore there is no Rotorcraft-Load Combination Flight Manual that has been approved by the FAA. The E7500 UAS was designed specifically for rotorcraft external-load operations, so the entire UFM is essentially the equivalent of a Rotorcraft-Load Combination Flight Manual. The content and structure of the UFM parallels the requirements of §133.47, including details describing load combinations. All payloads are pre-approved for flight by FulcrumAir engineers consistent with the UFM requirements and compliance with the UFM will therefore ensure an equivalent level of safety to the requirements of §133.47.

§ 133.49 Markings and placards

Section 133.49 states:

> §133.49 Markings and placards.
> The following markings and placards must be displayed conspicuously and must be such that they cannot be easily erased, disfigured, or obscured:
> (a) A placard (displayed in the cockpit or cabin) stating the class of rotorcraft-load combination for which the rotorcraft has been approved and the occupancy limitation prescribed in §133.35(a).
> (b) A placard, marking, or instruction (displayed next to the external-load attaching means) stating the maximum external load prescribed as an operating limitation in §133.45(b).

An exemption from §133.49 is necessary due to the size and configuration of the E7500 UAS, which makes it impossible to display the required placards without affecting the weight or operations of the UAS. FulcrumAir will ensure an equivalent level of safety by ensuring that the required documentation is available to the pilot at the GCS. Additionally, all slinging equipment is pull tested and rated, and the equipment is inspected prior to flight. The rigging equipment is inspected for any visible damage such as fraying, unraveling, missing payload ratings, staining, or any indication that the rigging gear is wet or otherwise compromised. *See* UFM page 16.

* * *

FulcrumAir has attempted to identify the appropriate FARs from which an exemption is needed in order to conduct the proposed operations in this petition for exemption. To the extent that the FAA determines that FulcrumAir needs an exemption from other FARs which are not addressed or explicitly named in order to conduct the proposed operations, FulcrumAir also seeks an exemption from those FARs for the reasons outlined above. For example, relief is not being sought from the minimum safe operating altitudes in §91.119(b) based on the language in §133.33(e) that "except as provided in §133.45(d), the holder of a Rotorcraft External-Load Operator Certificate may conduct external-load operations, including approaches, departures, and load positioning maneuvers necessary for the operation, below 500 feet above the surface and closer than 500 feet to persons, vessels, vehicles, and structures, if the operations are conducted without creating a hazard to persons or property on the surface." Additionally, FulcrumAir is not explicitly seeking relief from the medical certificate requirements in §61.23 based on its understanding that the medical certificate requirements of §61.23 are not applicable to a pilot that holds a Part 107 Remote Pilot Certificate, rather than a certificate issued under Part 61.

III. PUBLIC INTEREST

The proposed operations are in the public interest because they support wildlife conservation efforts. The E7500 UAS will be used to install BFDs on overhead power transmission lines. Each year between 12 and 64 million birds are killed as a result of collisions with transmission powerlines, with larger bodied birds (such as trumpeter swans, whopping cranes sand hill cranes, ducks and geese) being particularly vulnerable. Installation of BFDs has been shown to significantly reduce bird collisions with power transmission lines.[6]

The proposed Part 133 external-load rotorcraft operations will supplement or replace existing crewed aircraft operations while also substantially increasing pilot and worker safety. For example, the proposed operations significantly improve worker by eliminating the need to install the devices by hand one at a time from the skid of a helicopter. When installed by a helicopter, the helicopter is constantly flying in a high hover at a slow speed. This flight profile is avoided by crewed helicopter operations because recovery from engine failure by autorotation is nearly impossible (hence the reason this mission profile is often referred to as "dead man's curve" by helicopter operators). Moreover, when the crews install the devices using a crane, it takes an order of magnitude longer and cranes cannot be used over lakes or swamps, which is generally

[6] *See*, Loss SR, Will T, Marra PP. Refining estimates of bird collision and electrocution mortality at power lines in the United States. *PLoS One*. 2014;9(7):e101565. Published 2014 Jul 3. doi:10.1371/journal.pone.0101565, available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4081594/#:~:text=We%20conducted%20a%20quantitative%20review,million%20birds%20killed%20by%20electrocution.

where the devices need to be located. The use of cranes also exposes all the workers to the dangers of working at heights for extended periods of time.

In addition, the E7500 UAS is battery powered and creates no emissions. Use of a battery-operated UA rather than a fossil-fuel powered crewed aircraft for these operations reduces carbon emissions, which is in the public interest.

IV. FEDERAL REGISTER SUMMARY

FulcrumAir proposes the following summary for publication in the FEDERAL REGISTER:

Docket No.: FAA-2022-_____

Petitioner: FulcrumAir Corp.

Section(s) of 14 CFR Affected: 61.3(a)(1)(i), 91.7(a), 91.109(a), 91.151(b), 91.403(b), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), 91.417(a) and (b), 133.19(a), 133.21(a) and (b), 133.27(b), 133.33(a) and (b)(1), 133.43, 133.45(a)-(d), 133.47, 133.49 and 133.51.

Description of Relief Sought: FulcrumAir Corp. is seeking relief to operate the FulcrumAir E7500 UAS to provide commercial external-load rotorcraft operations in the United States under the authority of a Part 133 Rotorcraft External-Load Operator Certificate. The E7500 UAS is an electric vertical take-off and landing heavy lift coaxial helicopter designed to sling a machine used to install Bird Flight Diverters and other cable sensing machines on overhead power transmission lines located in low-risk remote and sparsely populated areas. The E7500 UAS has a maximum takeoff weight of 220 pounds. The petitioner intends to operate in Class G airspace at or below 400 feet above ground level. Operations will occur within visual line of sight of the pilot and during daylight hours only. The petitioner proposes to use a pilot in command holding a remote pilot certificate issued under 14 CFR part 107.

V. CONCLUSION

For the foregoing reasons, FulcrumAir respectfully requests that the FAA grant this petition for exemption. Should you have any questions, or if you need additional information to support FulcrumAir's requested relief, please do not hesitate to contact the undersigned.

Respectfully submitted,

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